

DOCUMENT RESUME

ED 123 753

EA 008 307

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TITLE Analytical Tools in School Finance Reform.
PUB DATE 76
NOTE 16p.; Paper presented at the Annual Meeting of the American Education Finance Conference (19th, Nashville, Tennessee, March 14-16, 1976); Best copy available

EDRS PRICE MF-\$0.83 HC-\$1.67 Plus Postage.
DESCRIPTORS *Educational Finance; Elementary Secondary Education; Equal Education; Expenditure Per Student; *Finance Reform; *Models; *Research Methodology; School District Spending; Statistical Analysis

ABSTRACT

This paper discusses the problem of analyzing variations in the educational opportunities provided by different school districts and describes how to assess the impact of school finance alternatives through use of various analytical tools. The author first examines relatively simple analytical methods, including calculation of per-pupil expenditures for different types of pupils and educational programs, calculation of the rank order correlation between school district wealth per pupil and per-pupil expenditure, and calculation of local tax effort compared to equalized property valuation per weighted pupil. Also described are more sophisticated analytical tools, including computation of a school district's fiscal neutrality score, computation of a Lorenz curve relating district wealth and per-pupil expenditure, computation of a coefficient of variation in expenditure per pupil among different school districts, computation of national, state, and local profiles of expenditure per classroom unit, computation of relative tax progressivity, comparison of changes in educational demand relative to changes in household income, and use of computer simulation models for testing alternative school finance proposals. (JG)

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ANALYTICAL TOOLS IN SCHOOL FINANCE REFORM

BY

R. L. JOHNS

The analytical tools selected to evaluate ^{an} existing school finance programs depend largely on the goals [REDACTED] of the [REDACTED] program. Students of school finance and informed laymen generally agree on the following: [REDACTED]

1. The finance program should result in ^{an} substantial equalization of educational opportunity throughout the state.

2. The [REDACTED] program should be fiscally neutral; [REDACTED] the quality and quantity of a child's education should not depend on the per capita wealth of the school district in which he lives.

3. The [REDACTED] program should be financed by an equitable system of taxation.

4. The [REDACTED] program should promote the efficient use of school funds.

^{there are} [REDACTED] of course, other goals of the school finance program, but these [REDACTED] seem to be the most generally accepted. [REDACTED]

In evaluating ^{a state's} [REDACTED] school finance program, [REDACTED] it seems logical ^{to} start ^{by} analysis ^{ing} [REDACTED] variation among the school districts [REDACTED] in [REDACTED] educational opportunities provided for pupils.

^{With} this approach, [REDACTED] we do not start with fiscal studies but [REDACTED] with a study of educational opportunities available. An excellent illustration of this approach is found in [REDACTED] J. Alan Thomas's

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study
 1968, entitled School Finance and Educational Opportunity in Michigan.
 Thomas
 made an extensive study of the educational programs available in both elementary and high schools in different types of districts. He found that variation in educational opportunities available in school districts was primarily due to variation in fiscal resources.

Following are some of the studies that should be made of the educational programs of each district of a state or at least of an adequate sample of the school districts of a state:

1. The percentage of eligible children in early childhood education programs, including kindergarten
2. The number and percentage who drop out before completing high school
3. The extent to which compensatory and remedial programs are being provided for the educationally disadvantaged
4. The percentage of students engaged in educational programs and activities during the summer months
5. The nature and extent of programs in vocational, career, and adult education
6. The extent to which provision is made for various kinds of special education and the percentage of students involved in such programs
7. The nature and extent of health, counseling, and other services provided
8. The availability of library and instructional materials resources.

These items relate primarily to access of pupils to educational programs. You will note that I have not included performance of students as

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measured by standardized tests. Numerous studies have shown that student performance as measured by standardized tests is largely a function of the socio-economic status of parents. Students will not achieve equally regardless of the financial resources available. However, all students should have equal access to the educational programs which meet their individual needs.

When [redacted] variations [redacted] in educational opportunity, ^{have been studied,} the next step is to identify the causes of those variations. Perhaps the best approach is start with an ~~overall~~ list of acceptable criteria for the evaluation of a state's school finance program. The National Education Association Committee on Educational Finance published a list of criteria for this purpose about 25 years ago, [redacted] [redacted] entitled "Guides to School Financing". They served a good purpose in assisting states to identify strong and weak elements in their programs of school financing.

In 1972,
The National Educational Finance Project developed [redacted] a set of criteria for the [redacted] evaluation of a state's school finance program. 1 [redacted] 4

These [redacted] are largely descriptive and are useful only in indicating strong and weak points. [redacted] We can assess the impact of alternative features of school finance programs only by the use of analytical tools, some quite simple and some quite sophisticated. Both types [redacted] should be used because persons not trained in educational finance have difficulty [redacted] understanding the sophisticated tools. It is particularly important that legislators, [redacted] [redacted], and classroom teachers understand the desirable and undesirable characteristics of school finance programs.

Let us first consider tools to use in measuring the equalization of educational opportunity. *It is generally assumed* [redacted] that fiscal equalization results in equalization of educational opportunity. This is true only when the plan recognizes necessary differences in per pupil costs [redacted] ^{of} programs [redacted] such as vocational education, exceptional education, [redacted] education for the culturally disadvantaged, etc. Furthermore, [redacted] variations in sparsity of population and in cost of living should also be included.

The most commonly used method of comparing the fiscal resources of school districts is to compare the per pupil expenditures for current

expense. Lay persons, including some legislators, frequently conclude that educational opportunity throughout a state would be perfectly equalized if the same amount of money is expended per pupil. No valid comparison of school expenditures of school districts can be made unless [REDACTED] cost differentials are recognized. Pupils should be weighted in order to take into account these cost differentials. The National Educational Finance Project developed cost differentials for different types of educational programs.² Differentials of this type can be used to weight pupils in proportion to cost variations. These weightings should be supplemented by weighting due to variations in sparsity of population and, theoretically, [REDACTED] in cost of living. Unfortunately, valid tools for measuring variations [REDACTED] in the cost of [REDACTED] the same standard of living have not yet been developed.

When the actual numbers of pupils in the school districts of a state have been converted into appropriately weighted pupils, [REDACTED] the current expenditure of each school district (excluding transportation and [REDACTED] food service) should be divided by the number of weighted pupils in the district. If the weighting of pupils has been properly accomplished, variations among school districts in the expenditure per weighted pupil indicate variations in fiscal equalization.

The next step is to identify the causes of those variations. In a state where a substantial portion of school revenue is derived from local property taxes, the most likely candidate is variation [REDACTED] in per pupil valuation of property. This can be examined simply by arranging the districts in order ^{by} [REDACTED] valuation per weighted pupil and comparing the expenditures per weighted pupil. The distribution can be broken into quartiles and the median or average expenditure per weighted pupil in each quartile can be computed.

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This [REDACTED] simple technique^{is} readily understood by legislators and other lay persons.

A more sophisticated method is to compute the Pearson coefficient of correlation or the Spearman rank order correlation between per pupil wealth and per pupil expenditure. I have found that legislators can generally understand this technique when it is explained briefly to them.

Variations among school districts in per pupil expenditures are also affected by methods of allocating state and federal funds and [REDACTED] by variation in local tax effort. Let us first examine the effect of state and federal funds on per pupil revenue. Graphical methods are suitable for this purpose. The National Educational Finance Project used such a tool for analyzing the extent of fiscal equalization among the school districts of a state.³ Briefly this method is as follows:

1. Arrange all by the districts in a state in order from highest to lowest equalized valuation per weighted pupil.
2. Select a stratified sample of 15-20 school districts in the state ranging from the highest to the lowest in equalized valuation per pupil.
3. Construct a composite bar graph for each of the sample districts using different types of shading or crosshatching for each section of the bar.
4. Compute the amount of local revenue per weighted pupil which is equalized by the state formula such as Strayer-Haig, percentage equalizing, power equalizing, guaranteed valuation, etc., and make this section 1 of the bar for the district.
5. Compute the amount of state funds per weighted pupil received by the district from the total of state equalization and flat grant appropriation and make this section 2 of the bar.
6. The total of section 1 plus section 2 constitutes the basic state

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program guaranteed by the state to the district. In a number of states it will be found that the state guarantees different levels of programs for different districts. This is particularly true [redacted] where the amount of state funds received by a district depends on the level of local tax effort [redacted] as a power equalizing formula.

7. Compute the categorical state aid per weighted pupil received by the district and make this section 3 of the bar.

8. Compute the non-equalized local revenue per weighted pupil available to the district and make this section 4 of the bar. This revenue is, sometimes called local leeway revenue.

9. Compute the federal funds per weighted pupil received by the district and make this section 5 of the bar.

10. The total length of the bar is the sum of section^s 1, 2, 3, 4, and 5. If there is substantial equalization of fiscal resources, the bars will be approximately equal for all districts regardless of variations in equalized valuation per weighted pupil. (Ideally, the revenue used for school transportation and school food service should be deducted in the above computations.) The bars for the sample districts make a profile of the total school finance program of the state, [redacted] and will reveal what types of school revenue are disequalizing. In most states, the principal disequalizing factor is the unequalized local leeway revenue.

This chart will also reveal whether federal funds are disequalizing. [redacted]

[redacted]

Some [redacted] variations in local tax effort in proportion to equalized valuation per weighted pupil are revealed by the chart described above, but [redacted] local tax effort for all districts should be computed. The standard method [redacted] is to compute the tax rate on the equalized valuation of each district. In many states, it has been found that many

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districts of low equalized valuation per pupil have higher equalized tax rates for schools than districts of much greater wealth. Nevertheless, the higher tax rates in the districts of low wealth do not generally yield the local leeway revenue per weighted pupil of the districts of high wealth and lower tax rates.

Heretofore, I have discussed simple tools for analyzing state finance programs which can readily be understood by the [REDACTED] public. I shall now discuss a few of the more sophisticated analytical tools [REDACTED] used by research scholars. These [REDACTED] are usually more precise than the tools described above and some of them can be programmed for computers.

1. The National Educational Finance Project Equalization Score.

This ~~tool~~ should have been called the fiscal neutrality score instead of the equalization score because it measures fiscal neutrality rather than fiscal equalization. The method of computation is described in Volume 4 of the National Educational Finance Project entitled Status and Impact of Educational Finance Programs.⁴ [REDACTED]

[REDACTED] Briefly, it is based on the following assumptions:

1. That local school funds provide no financial equalization unless local variations in taxpaying ability are taken into consideration in the state's apportionment formula.

2. Assuming that a given amount of state revenue is apportioned to the districts of a state:

a. No equalization is obtained if state dollars are required to be matched dollar per dollar from local funds.

b. The first level of equalization is reached when state funds are allocated in [REDACTED] uniform flat grants per teacher or per pupil without taking into consideration necessary variations in unit costs^{or} [REDACTED] variations in local taxpaying ability.

c. The second level of equalization is reached when state funds are allocated in [redacted] flat grants which take into consideration necessary unit cost variations but [redacted] do not [redacted] consider [redacted] variations in local taxpaying ability.

d. The third level of equalization is reached when state funds are allocated in [redacted] uniform flat grants without [redacted] consider [redacted] [redacted] but [redacted] tak^{ing} into consideration variations in local taxpaying ability.

e. The fourth and highest level of equalization is obtained from a given amount of a state revenue when it is allocated in such a manner as to take into consideration ^{both} necessary variations in unit costs and [redacted] variations in ^{local} taxpaying ability, [redacted].

[redacted] the NEFP Typology classifies local and state funds into five levels of financial equalization [redacted] rang^{ing} from Level 0 to Level 4.⁵

The lowest level of equalization [redacted] was assigned a value of 1 and the highest level [redacted] was assigned a value of 8.4.

[redacted] In 1968 the NEFP computed the equalization scores of all fifty states and found that they ranged from a low of 2.3 in Connecticut to a high of 8.4 in Hawaii. This technique provides no information concerning the variation among the districts of the fiscal resources available for educational programs. However, it may be assumed that the equalization score is negatively correlated with the coefficient of variation among districts of fiscal equalization.

2. The Lorenz Curve and the Gini Index or Coefficient. This tool has recently been used by Hickrod, Hubbard, and Yang of Illinois State University in a number of state studies.⁶ The Lorenz Curve is developed by plotting [redacted] data for cumulative proportions of pupils and cumulative proportions of spending expenditures on coordinate axes.

The districts are sorted in ascending order of wealth per pupil. The cumulative proportions of pupils in the districts are represented by the horizontal axis and the cumulative proportions of total operating expenditures accounted for by these districts are represented by the vertical axis. The curve thus plotted would be a straight line if the operating expenditures per pupil were the same in all districts. A sagging curve represents lesser expenditure in poorer districts. The measure of this inequality as defined by Gini Coefficient G is given by the ^{following} formula:

$$G = \frac{\text{Area A}}{\text{Area (A+B)}}$$

In this formula, [redacted] A is the area between the sagging Lorenz curve and the line marking the 45 degree angle and [redacted] B is the area below area A and above the horizontal axis. When the Gini index is equal to 1.0, complete inequity exists; [redacted] when the index is 0.0, complete equity exists.⁸ This ^{simple} technique [redacted] can readily be programmed for computer simulation. It does not provide any information concerning the variation among districts of fiscal equalization, [redacted] ^{but} it can be assumed that the Gini Index correlates positively with the coefficient of variation among districts in fiscal equalization. If the Gini Index is computed on the basis of weighted pupils, it is a measure of fiscal equalization rather than fiscal neutrality. For example, (it would be impossible) in a state using the power equalizing formula to attain a Gini Index of 0 if different types of districts make varying levels of local effort.

3. Coefficient of variation. This is a very simple measure. The current expenditure per weighted pupil (excluding expenditures for transportation and school food service) is computed for each district in the state. The mean and the standard deviation for the distribution are computed. The coefficient of variation is computed by dividing the

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standard deviation by the mean and multiplying the quotient by 100. This technique produces a standardized measurement [REDACTED] appropriate for comparisons among states with different levels of school revenue.⁹

4. Profiles in School Support. The United States Office of Education for 5 decennial periods beginning in 1930 has developed profiles of school support which indicate the degree of equalization of fiscal resources and also the level of support in each state compared with the national median. Paul Mort developed the first of these profiles for the year 1930.¹⁰ The latest of these profiles has been developed by Eugene McLoone for the year 1969-70.¹¹ Under this technique, "classroom units are based on the prevailing practice of average number of pupils per teacher for elementary schools and for secondary schools with a further allowance for schools with fewer than 700 pupils. Prevailing pupil-teacher ratios for the nation by enrollment size and type of pupil were used."¹² This [REDACTED] produced a crude type of weighted classroom unit as compared with the more refined weighted pupil unit. The current expenditure per classroom unit is plotted on the horizontal axis and the cumulative per cent of classroom units on the vertical axis. This profile constructed for each state shows the national median classroom unit expenditure, the state median classroom unit expenditure, and [REDACTED] the amount of deviation below the median of classroom unit expenditures. A comparison of the profiles of the states for decennial periods gives evidence of the progress or regression of a state toward equalization of financial resources.

McLoone made some additional computations from the data collected for the profiles. Those computations included the percent^{ages} of current expenditure in each state that would be required to raise the expenditures per classroom unit to the state median and [REDACTED] the national median. McLoone also computed the coefficient of inequality for each state for each of the

five decennial periods. This coefficient indicates the degree to which funds are unequally distributed in the state or nation. If every student in the state or nation had the same amount of funds expended for him, the coefficient would be zero. As the funds distributed to students become unequally distributed, the coefficient increases toward 1.00. The method of computing the index of inequality is found in "The Anatomy of Income Distribution" by James Morgan. Review of Economics and Statistics, 44:281, August 1962. McLoone found that the coefficient of inequality had been reduced substantially in the nation and in most states since 1930.

5. The Equity of the Taxes Used to Support Education. If progressivity of the tax is considered equity, [REDACTED], the most equitable taxes are federal taxes, the next most equitable are state taxes, and the least equitable are local school taxes. These are four major sources of tax revenue listed in order of progressivity: personal income taxes, corporate income taxes, sales and excise taxes, and property taxes. These four [REDACTED] sources provide 94 percent of all federal, state, and local tax revenue. Eighty-two percent of all federal tax revenue is derived from personal and corporate income taxes. Twenty-six percent of state tax revenue is derived from personal and corporate income taxes and 57 percent from sales and gross receipts taxes. Local school districts derive approximately 98 percent of their tax revenue from local property taxes. Therefore, the higher the percent^{age} of school revenue derived from federal ~~sources~~ and state sources and the lower the percent^{age} of school revenue derived from local property taxes, the more equitable the taxing system. Furthermore, the higher the percent^{age} of state ^{school} revenue [REDACTED] [REDACTED] derived from personal and corporate income taxes, the more equitable the taxing system. The National Education Association, the American Association of School Administrators, and other influential organi-

zations have recommended that the federal government provide 30 percent or more of school revenue.

The National Educational Finance Project developed a measure of the relative progressivity of the tax revenues for the public schools of each state from federal, state, and local sources.¹³ [REDACTED]

[REDACTED]. It is described in detail in Volume 5 of the National Educational Finance Project entitled Alternative Programs for Financing Education. Briefly, the federal personal income tax was assigned a progressivity value of 50 and the relative progressivity of other tax sources was computed in proportion. [REDACTED]

[REDACTED]. For example, state personal and corporate income taxes were assigned a progressivity value of 35, state sales taxes a value of 15 and property taxes a value of 14. The proportion of school revenue derived from each source was computed and a composite progressivity score was computed for each state. [REDACTED] ranging from a low of 15.7 in New Hampshire to highs of 25.7 in Alaska, 24.2 in Delaware, and 23.5 in North Carolina. In general, the higher the percent^{age} of revenue for school derived from federal and state sources, the higher the progressivity score.

This technique may be considered a relatively crude tool of analysis, but it does provide a method for comparing the relative progressivity of the tax systems of the states used to finance the public schools.

6. Income Elasticity of Demand. Has public school support increased over a period of years in proportion to the increased economic activity of the nation? The answer to this question can be obtained by comparing the relative change in the quantity of education demanded over a period of time with the relative change in household income. Economists call this

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measure "income elasticity of demand". It is determined for education by comparing changes in current expenditures per pupil for education with changes in per capita personal income. A coefficient of 1 means that a 1 percent change in per capita income has been accompanied during the period of years studied by a 1 percent change in per pupil expenditure. If the coefficient is more than 1, the demand is called elastic and when less than 1, inelastic.¹⁴

7. Computer Simulation Model. The most efficient tool for testing alternative proposals for a school finance program is the computer simulation model. It is now possible to develop a computer simulation model with interacting components which can (reveal quickly) the impact on individual districts of an almost unlimited number of alternative provisions in school finance programs. Legislators frequently submit bills incorporating provisions affecting school finance without being aware of what they will cost, what their impact will be on individual districts, and whether they will be equalizing or disequalizing. The computer simulation model, if properly developed, [redacted] answer [redacted] these and other questions.

A number of these simulation models have been developed. They have to be adopted for each state. The National Educational Finance Project has developed a computer simulation model entitled NEFP Decision Process "A Computer Simulation".¹⁵ This model has been adopted for use in a number of states.

[redacted] other tools of analysis of school financing systems have been used and [redacted] new ones will no doubt be developed. The purpose of this paper has not been to describe all of the possible tools of analysis but to describe some of the most useful and most commonly used. [redacted]. I trust [redacted] that purpose has been accomplished.

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FOOTNOTES

1. [REDACTED]
2. Ibid., p. 272.
3. See Vol. 4 of National Educational Finance Project entitled Status and Impact of Educational Finance Programs, Roe L. Johns, Kern Alexander, and Dewey Stoller, eds., pp. 55-109.
4. Roe L. Johns, Kern Alexander, and Dewey Stollar, eds., Status and Impact of School Finance Programs, Gainesville, Fla.: National Educational Finance Project, 1971, pp. 127-136.
5. Ibid., pp. 124-125.
6. Hickrod, G. Alan, Ben C. Hubbard and Thomas wei-chi Yang, The 1973 Reform of the Illinois General Purpose Grant in Aid, Normal, Illinois: Department of Educational Administration, Illinois State University.
7. Ibid., p. 79.
8. See also Thomas wei-chi Yang, Measurement of School Revenue Equity in the States of Illinois, Michigan and Kansas, Normal, Illinois, Illinois State University, Doctoral Dissertation, 1975.
9. Ibid., p. 28.
10. Paul R. Mort and Research Staff, State Support for Public Education, Washington, D.C.: American Council on Education, 1933.
11. McLoone, Eugene P., Profiles in School Support, 1969-70, Washington, D.C.: U.S. Department of Health, Education and Welfare, Education Division, National Center for Education Statistics, U.S. Government Printing Office, 1974.
12. Ibid., p. 4.
13. Roe L. Johns and Kern Alexander, eds., Alternative Programs for Financing Education, Gainesville, Fla.: National Educational Finance Project, Vol. 5, 1971, pp. 253-263.
14. Johns, Roe L. and Edgar L. Morphet, The Economics and Financing of Education, Englewood Cliffs, N.J.: Prentice Hall, Inc., 1975, pp. 131-132.
15. Boardman, Gerald R., NEFP Decision Process, "A Computer Simulation of Planning State School Finance Programs", 1212 S.W. 5th Ave., Gainesville, Fla., National Educational Finance Project, 1973.
1. See Roe L. Johns, "Improving the Equity of School Finance Programs," Journal of Education Finance, [REDACTED], no. 3 (1976): 540-549.